Consolidated Space Operations Contract

Ka-Band Transition Product (KaTP) Space Network (SN) Upgrades

Transition Plan

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Preface

This document provides the plan for the transition of the Ka-Band Transition Product's Ka-Band Single Access Return (KaSAR) Space Networks Interoperability Panel (SNIP) service (225 MHz channel) and KaSAR1 Wide-band (KaSAR1WB) Intermediate Frequency (IF) service (650 MHz channel) from a NASA/SODA development activity into CSOC operations, maintenance, and sustaining engineering activities. This document is specifically written to establish guidelines and responsibilities for the orderly handover of the new services from NASA/GSFC Code 450 to CSOC sustaining support. It is intended to provide a plan for the Transition Team to follow. This plan will ensure a smooth transition of the system/services into routine operations and maintenance.

This document provides an overview of the activities related to the integration, installation, testing, and transition of the new services to operations.

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1 Introduction

1.1 Purpose

The purpose of this Transition Plan is to detail the activities necessary for the successful transition of the Space Network (SN) upgrades that are being implemented under the Ka-Band Transition Product (KaTP) to new operational SN services. The new SN services are:

1. Ka-Band Single Access Return (KaSAR) Space Networks Interoperability Panel (SNIP) service (225 MHz channel)
2. KaSAR1 Wide-band (KaSAR1WB) Intermediate Frequency (IF) service (650 MHz channel)

These services are being developed under the KaTP through the National Aeronautics and Space Administration (NASA) Consolidated Space Operations Contract (CSOC) Space Operations Directive Agreement (SODA) task to sustaining operations at the White Sands Complex (WSC). By identifying roles and responsibilities, specific system configurations, and test approaches, each organization can plan for the new services and identify potential risks as they arise.

1.2 Scope

The scope of this document is to provide a plan for the KaTP Transition Team to follow so that a smooth transition of the new services into an operational environment can be accomplished. The plan describes the following major steps for the transition of the KaTP upgrades to operations:

- Identification of required documentation to be in place prior to transition.
- Completion of training of the operations and maintenance staff.
- Phase-in of service after successful system acceptance testing.

1.3 Goals (Entire KaTP Program)

The primary goals of the entire KaTP program, which include both SN and Ground Network (GN) upgrades, are as follows:

a. Develop a new KaSAR SNIP service for inclusion in the Space Communications and Data Systems (SCDS) Services.

b. Develop a new KaSAR1WB IF service for inclusion in the SCDS Services.

c. Develop a Ka-band Ground Station at the Wallops Flight Facility (WFF) to demonstrate GN Ka-band operations and provide for future commercialization of the GN.

d. Provide test beds within the SN and GN to demonstrate new communications technologies such as:

    - Bandwidth-efficient modulation and coding techniques
    - high data rate receivers (at least 600 Mbps)
    - High rate data processing and storage devices

e. Provide the impetus and confidence to flight and ground system customers to utilize NASA's allocated Ka-band spectrum by demonstrating candidate Ka-band solutions.

1.4 KaTP Program Overview

1.4.1 Background

NASA intends to use Ka-band for the transmission of high rate data from near-Earth missions primarily because of concerns over the increasing congestion in the frequency bands that science spacecraft currently use. NASA's SN currently provides communications support at S-band and Ku-band to a variety of science spacecraft via the Tracking and Data Relay Satellite System (TDRSS) spacecraft and the ground assets located at the WSC. Similarly, NASA's GN provides communications support at S-band and X-band to science spacecraft via direct links to ground stations located worldwide. NASA's forecasts for Earth exploration-satellite (EES) mission requirements reflect the need for telemetry data rates up to 1.0 Gbps and beyond. These escalating data throughput requirements cannot be supported by the SN and GN using the present Ku-band and X-band spectrum, respectively. Additionally, NASA's TDRSS Ku-band forward and return links have secondary allocations from the International Telecommunications Union (ITU). Therefore, fixed satellite service Earth stations transmitting in the Earth-to-space direction will likely generate increasing interference to the TDRSS forward links. In recognition of these constraints, NASA and space agencies of other countries through their administrations have been developing regulatory provisions that will enable a more intense use of the 26 GHz band to satisfy earth science and space science service requirements. The 26 GHz band has a primary allocation from the ITU for both Inter-Satellite Service (ISS) and EES service, and does not suffer from the congestion and interference that has become increasingly likely in the lower frequency bands.

Starting in 2000, NASA/Goddard Space Flight Center (GSFC) launched the first of three new next generation Tracking and Data Relay Satellites (TDRS) known as H,I,J to enhance the SN's support to Low Earth Orbit (LEO) spacecraft. TDRS H,I,J maintains compatibility with existing customer spacecraft at S- and Ku-bands while adding a Ka-band space-to-space link communications capability. The TDRS H,I,J Ka-band space-to-space links operate in bands that are allocated on a primary basis to ISS. NASA currently operates in Ku-band for space-to-space links that are allocated on a secondary basis, therefore NASA may be subject to operational Ku-band restrictions in the future. The Ka-band space-to-space forward link operates in the 22.55 GHz to 23.55 GHz band. The Ka-band space-to-space return link from the customer spacecraft to TDRS H,I,J operates in the 25.25 to 27.5 GHz band. For the Ka-band return link, the TDRS H,I,J spacecraft have two channel options which are the 225 MHz bandwidth channel and the 650 MHz bandwidth channel. Both channels are tunable across the band. The TDRS space-to-ground links continue to operate at Ku-band.

In June 2000, NASA launched TDRS H which is now fully operational at 171 degrees west longitude. NASA launched TDRS I in March 2002. TDRS I is currently undergoing orbit raising maneuvers after which on-orbit payload testing will commence. TDRS J is currently under development. NASA has scheduled the TDRS J launch for November 2002.

The TDRSS ground stations located at NASA's WSC are currently capable of supporting Ka-band customers via TDRS H,I,J at data rates up to 300 Mbps via the TDRS H,I,J 225 MHz bandwidth channel (HIJ delivered system does not support the SNIP frequency plan for the

225 MHz channel). This capability was implemented by the TDRS H,I,J development contractor. However, the WSC cannot support the Ka-band wideband return link (650 MHz bandwidth channel) which is provided by the TDRS H,I,J spacecraft. This high rate return capability at WSC was not required as part of the TDRS H,I,J development contract and was left for NASA to implement at a later date.

1.4.2 SN Upgrades

Under the KaTP program, NASA is upgrading the SN ground stations at the WSC to take advantage of the new TDRS H,I,J spacecraft 650 MHz bandwidth channel for Ka-band space-to-space return links in the 25.25 GHz to 27.5 GHz band.

NASA is implementing a prime and redundant 650 MHz bandwidth channel IF service at four of the five KSAR-1 downlink services at the WSC Space-Ground Link Terminals (SGLTs) by adding new downconverters and waveguide equalizers. The new downconverters can receive a 650 MHz-wide Ku-band signal, that the TDRS H,I,J spacecraft provide, and can output a 1200 MHz IF signal that is being fed into the new IF switch. The equalizers correct phase and amplitude distortions that result when wide-band signals propagate through the long WSC Ku-band waveguide runs. Additionally, NASA is modifying the software and firmware at WSC to support the scheduling, control, and monitoring of the new and modified hardware.

Also under the KaTP program, NASA is modifying the existing WSC 225 MHz bandwidth channel prime and redundant downconverters to support two different Ka-band frequency plans which are the TDRS H,I,J frequency plan and the SNIP frequency plan. The SNIP Ka-band frequency plan contains Ka-band forward and return center frequency recommendations for space-to-space link communications via data relay satellites. The SNIP developed their Ka-band frequency plan in order to promote interoperability among NASA, European Space Agency (ESA), and National Space Development Agency of Japan (NASDA) space networks.

1.4.3 GN Upgrades

NASA is installing a single GN Ka-band ground station at the NASA/GSFC WFF in Virginia, to support unified S-Band command (2025 to 2120 MHz) and telemetry (2200 to 2300 MHz), and Ka-Band telemetry (25.5 to 27.0 GHz). The ground station consists of a 5.4 meter X-Y mount antenna which is housed in a radome with a Ka-band cassegrain feed and a S-band prime focus feed. The Ka-band ground station equipment provides an IF output at 1200 MHz with an interface that is identical to the SN Ka-band IF output. The ground station supports simultaneous Ka-Band and S-band telemetry receive, S-band command transmit, and S-band and Ka-band antenna autotrack.

When the SN and GN implementations are complete in the second half of 2002, NASA will perform high data rate demonstrations (600 Mbps) by using a high data rate test receiver and transmitter.

1.5 Description Of WSC System Upgrades

The WSC portion of the SN requires both hardware and software changes to implement the new KaSAR SNIP service and KaSAR1WB IF service. No significant facility modifications are required to implement these services.

In order to implement the KaSAR SNIP service, a dual frequency local oscillator (LO) is being installed in the 225 MHz bandwidth downconverters and modifications to the existing High Data Rate Controller (HDRC) command requests for the 225 MHz KSAR1 and KSAR2 are being implemented so that either the SNIP or TDRS-H,I,J center frequencies can be selected via a Scheduling Order (SHO) (i.e., based on the user transmit frequency).

The KaSAR1WB IF service implementation requires modifications to TDRS-H,I,J compatible WSC hardware and Data Service Management Center (DSMC) software to allow automatic scheduling and configuration of this service. A prime and redundant 650 MHz IF service for the KSA1 side of SGLT's 1, 2, 4, and 5 is being implemented.

1.5.1 Hardware

Figure 1-1 depicts the hardware upgrades required to implement the KaSAR SNIP service and KaSAR1WB IF service. Except for the modified Radio Frequency (RF) power dividers in the Intrafacility Links, no existing equipment in the Intrafacility Links, Ku-band Low Noise Amplifier (LNA) Assemblies, Ku-Band Feed Assemblies, or Antenna Reflector Assemblies is being modified.

1.5.2 Software

New or modified software and firmware is required at the WSC for the new equipment in Figure 1-1, the modified equipment in Figure 1-1, the Automated Data Processing Equipment (ADPE) control and monitor equipment for each SGLT, and the TDRSS Operations Control Center (TOCC). The new or modified software/firmware includes the following:

- Normal KaSAR service messages are being modified to include Ka-Band Single Access-1 Narrowband (KaSA1NB) with a SNIP frequency and Ka-Band Single Access-2 Narrowband (KaSA2NB) with a SNIP frequency as a valid Service Support.
- Normal KaSAR service message formats are being modified to include KaSA1WB as a valid Service Support.
- Graphical User Interface (GUI) and Database changes corresponding to message format changes.

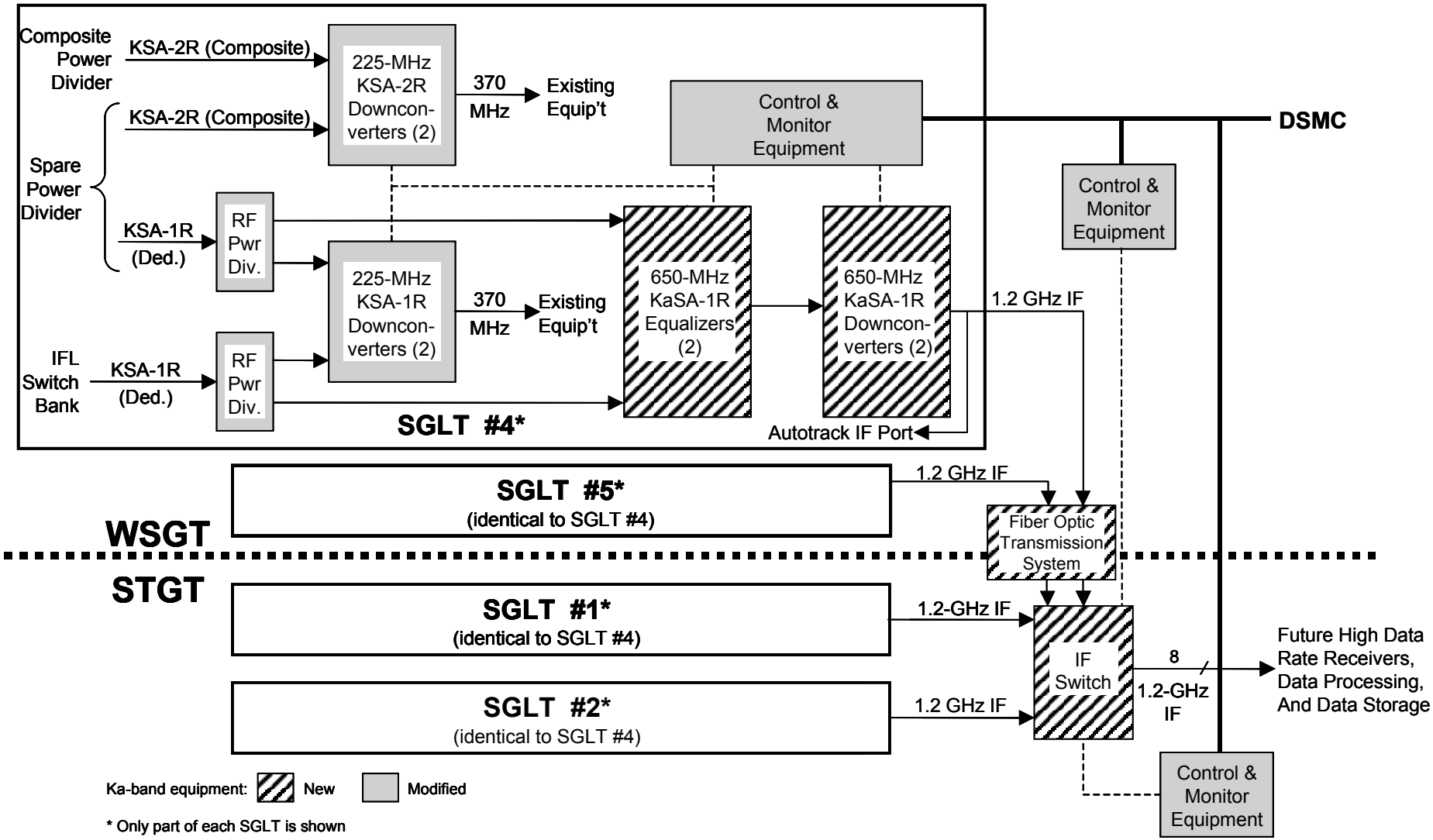

Figure 1-1. SN KaTP Hardware Configuration

1.6 Roles and Responsibilities

The WSC Systems Engineering Department is responsible for the system level design, implementation, high data rate demonstrations, and testing of the capabilities delivered under the SN portion of this KaTP project. The WSC Systems Engineering Department is also responsible for the system and subsystem level requirements, procurement (or manufacture), system acceptance tests for all hardware and associated commercial components, and management of the technical baseline.

The WSC Systems Engineering Department is ensuring that the technical performance of the SN portion of the KaTP program meets the requirements in the KaTP System Requirements Document (SRD). The WSC Systems Engineering Department is acting as the primary technical interface within the WSC community and with NASA in matters that relate to the implementation of the WSC Ka-band upgrades. The WSC Systems Engineering Department has been interfacing with vendors and software designers, both in-house and at vendor facilities, to provide an integrated understanding of the requirements and to ensure a proper interpretation and compliance with the requirements.

The WSC Systems Engineering Department performs system analyses and trade studies, and provides leadership in risk identification and assessment analysis, and risk mitigation. The WSC Systems Engineering Department has developed System Acceptance Test Procedures for verifying KaTP system integration, installation, and implementation. The System Acceptance Test Procedures include verification of KaTP SRD requirements and interfaces.

The WSC Operations and Maintenance (O&M) group within CSOC is responsible for the local operations and maintenance of the delivered upgrades. CSOC O&M is being equipped with the recommended tools, test equipment, and spares in order to meet the availability requirements. Spares are being purchased to meet the availability requirement. Technicians have the responsibility for manual systems operations to conduct tests, isolate anomalies, and perform Level 1 and Level 2 maintenance activities on Ka-band systems. CSOC O&M personnel are ensuring that documentation baselines are established, changes to baselines are controlled, and delivered items are validated. Existing WSC procedures and tools are being used to support hardware configuration management of the KaTP upgrades.

The WSC Software Engineering Section is responsible to perform all software and firmware designs in response to subsystem requirements, custom software development, custom and commercial software integration, and acceptance testing of customer and commercial software.

The WSC DSMC is supporting system software changes and System Acceptance Tests, operational engineering tests, and demonstrations. The DSMC will have the capability to schedule, reconfigure, and monitor the new KaSAR SNIP service and KaSAR1WB IF service.

2 Transition Activities

This section discusses the migration of the KaSAR SNIP service and KaSAR1WB IF service (currently under NASA/SODA development at WSC under KaTP project) into CSOC/WSC Operations & Maintenance (O&M) and sustaining engineering.

2.1 System Reviews, Tests, and Demonstrations

Below are the major system reviews, tests, and demonstrations (completed and planned) for the SN portion of the KaTP Project.

Review	Date	Status
KaTP System Design Review	12-19-00	Completed
KaTP SN System Acceptance Testing	09-02-02 to 11-08-02	Planned
KaTP SN Demonstration	12-02-02 to 12-20-02	Planned
KaTP SN Operations Readiness Review	01/15/03	Planned
KaTP SN Upgrades Transition Readiness Review	01/15/03	Planned

Request For Actions (RFAs) are generated at reviews by members of the Technical Review Team (TRT) and by review attendees. For each open RFA, the KaTP team will provide the original question and a written approach or recommendation specifying the action to be taken for closing the RFA.

2.2 Transition Agreement

The transition of the services to CSOC will utilize the "Transition Agreement Between The National Aeronautics And Space Administration's Goddard Space Flight Center And The Lockheed Martin Space Operations Company Concerning Transition Of The Ka-Band Transition Product (KaTP) Space Network (SN) Upgrades" as a basis for transition. The transition process will entail an evaluation by the CSOC contractor of the state of the KaSAR SNIP service and KaSAR1WB IF service for operational use. The evaluation process will encompass the generation of a Preliminary Transition Readiness Review (TRR) report by CSOC which will evaluate the new services state of readiness. The Preliminary TRR report may be in a briefing slide format. CSOC will present its Preliminary TRR report at the Transition Readiness Review (TRR). The Preliminary TRR report will identify any outstanding issues, discrepancies, and/or system liens, which preclude a transition to the new services. CSOC will finalize the TRR report based on comments at the TRR. The CSOC WSC O&M Department shall assume responsibility of operations of the new services after all TRR discrepancies are resolved and upon CSOC's determination that the services meet the criteria for acceptance into the CSOC completion form. All discrepancies stated at the TRR and their resolution will be described in the signature version of the Final TRR report. Operations, Maintenance and Sustaining Engineering for the new services will be performed at the WSC.

2.2.1 Assumptions

a) Throughout the new services development, the WSC Systems Engineering Department is responsible for complete systems development, internal integration, and systems testing.

b) WSC Systems Engineering Department is performing the system acceptance tests and will perform demonstration tests.

c) The WSC DSMC personnel are supporting system acceptance tests and will support the demonstrations tests.

d) WSC Systems Engineering Department is providing thorough documentation and training for the services successful transition into operations.

2.2.2 Constraints

The KaSAR SNIP service and KaSAR1WB IF service transition to operations will follow successful demonstration testing and operator training at WSC.

2.2.3 Security

The new service upgrades shall adhere to the NASA Procedures and Guidelines for Security of Information Technology, NPG 2810.1. For all aspects of communications via NISN, the new services shall comply with IP Operational Network (IONet) Security Plan, 290-003 and IP Operational Network (IONet) Access Protection Policy and Requirements, 290-004. However, in case of conflicts between NPG 2810.1, 290-003, and 290-004, 290-003 and 290-004 have precedence.

There are currently no known security issues related to the KaSAR SNIP service and KaSAR1WB IF service.

2.2.4 Risk Assessment

The WSC Systems Engineering Department, CSOC Operations and Maintenance, and WSC security will identify any liens against the system, evaluate risks, and prepare mitigation efforts to minimize potential impact to operations. The risk assessment will be discussed at the TRR.

2.2.5 Baseline Management During Transition

CSOC O&M will establish a hardware and software baseline configuration freeze prior to the beginning of transition. During the transition, all KaTP changes to the baseline will be in accordance with the KaTP Engineering Change (EC), EC-8272, that was approved by the CSOC WSC configuration control board (CCB).

2.3 System Build-up And Transition Schedule

The KaSAR SNIP service and KaSAR1WB IF service is being thoroughly tested at WSC prior to the transition. The WSC Systems Engineering Department is also providing WSC Operator coordination and formal training. The services' Operational Readiness Review (ORR) will be convened in conjunction with the TRR.

2.3.1 Training

The WSC training instructor and site management is providing CSOC personnel with the administrative, operations, and maintenance training required to maintain and operate the system effectively. The training schedule is being organized to ensure that the schedule allows individuals who require more than one course to take all needed courses in a logical sequence. The KaSAR SNIP service and KaSAR1WB IF service user training will also be incorporated into the NASA/CSOC TDRSS Orientation Course (STDN 880/890 Training).

2.3.2 Test and Checkout

The transition of new services from NASA/SODA to CSOC operations will begin after successful completion of system installation, system acceptance testing, and demonstration testing at WSC. The WSC Systems Engineering Department is conducting the installation and checkout for the WSC upgrades. Also, the WSC Systems Engineering Department is verifying the configuration of the upgraded systems, custom and Commercial Off-The-Shelf (COTS) software, and network configurations.

2.4 Operations Transition

2.4.1 Staffing and Recurring Costs

WSC CSOC has identified a recurring labor cost of 606 hours/year for preventive maintenance and corrective maintenance activities. However, there will be no recurring costs to lease any hardware or software to support the new services.

2.4.2 Phase-In Strategy

The KaTP Transition Manager will monitor phase-in activities closely, and report to CSOC O&M as needed. Adjustments will be proposed, as required, to meet the phase-in schedule. The phase-in support will be provided by technical personnel, who have a comprehensive understanding of the new services and equipment, to assist in the areas of hardware and software maintenance, installation, test, and documentation of changes.

All reference documentation, supplies, spare parts, or relevant materials will be made available to CSOC O&M prior to cutover to the new services. KaTP project-developed documentation will be in electronic form whenever possible. CSOC O&M will prepare preventive and corrective maintenance procedures as required.

Refer to Appendix C for a Point of Contact (POC) list.

2.5 Configuration Management

The CSOC Program Configuration Management (CM) Office establishes program wide CM policies. The process in accordance with the CSOC CM Plan (CSOC-CEN-PI50.001037) will be followed to track any changes to the baseline configuration.

The Discrepancy Report (DR) system at WSC will be used to record problems and their resolution. DRs will be utilized during the Demonstration phase and during System testing, if

appropriate. Any unresolved DRs and their disposition will be discussed at the Transition Readiness Review.

2.6 Documentation

The KaTP Program will provide proper hardware, software, and systems documentation as part of the system delivery to CSOC O&M. Refer to Appendix B for a detailed listing of all KaTP deliverables that will be in place prior to transition.

2.7 Operational Readiness Review and Transition Readiness Review

A Transition Readiness Review (TRR) will be conducted after integration of the KaTP equipment into the Space Network. The integration and test results will be presented at the TRR. The capabilities, performance, and operational characteristics of the SN KaSAR SNIP service and KaSAR1WB IF service will be baselined at the TRR. The ORR will be conducted in conjunction with a TRR to certify that the KaSAR SNIP service and KaSAR1WB IF service are operationally effective and suitable for use in day-to-day operations.

Prior to the TRR, system acceptance testing and demonstration tests will be performed at WSC to validate performance and functional capabilities. Also, prior to the TRR, the CSOC contractor will validate the newly prepared local operating procedures (LOPs). The CSOC WSC Systems Engineering Department will work with CSOC O&M to prepare the Preliminary and Final Transition Readiness Reports to document any actions, DRs, or liens on the system.

3 System Integration, Installation, And Acceptance

3.1 Introduction

The ultimate determination of the success or failure of system development is the use and operability of the delivered system in its intended environment. Integration, installation, and acceptance must be conducted in a controlled, orderly, and timely manner to ensure that the delivered system is technically successful.

3.2 System Integration and Integration Portion of System Acceptance Tests

The purpose of system integration is to ensure that the delivered system continues to meet its requirements after integration with external systems at the installation site. The purpose of the integration portion of the system acceptance testing is to determine whether the integrated system or system build meets all requirements allocated to it. At the conclusion of system integration and the integration portion of system acceptance testing, the system can be demonstrated to the users that it can be installed in its operational location with assurance that it will perform successfully.

System integration and the integration portion of the system acceptance testing focuses on the interfaces between system components and on the interactions among system components. Testing will verify functional correctness, system stability, system operability, and system performance.

During the transition period, operators and users should become familiar with the new system while minimizing the disruption to ongoing operations.

3.3 System Installation and Installation Portion of System Acceptance Tests

Defining an acceptance criteria and demonstrating that the installed system will meet that criteria in the operational environment via the installation portion of system acceptance testing results in system acceptance.

An Engineering Change, EC-8272, for the KaTP upgrades to the WSC facilities baseline was developed and approved by the CSOC WSC CCB. The installation procedures will be in accordance with the site facility requirements. The capabilities are expected to be fully operational for day-to-day operations.

The installation portion of the system acceptance testing is being conducted in accordance with the approved test procedures to determine that the system meets functional capabilities and operational interface requirements.

Configuration control of WSC software and firmware is being maintained in the Software Maintenance Test Facility (SMTF) under procedures managed by the SMTF organization. The CSOC WSC Software Review Board must approve software changes to the baseline. This board institutes the process for submitting and evaluating change requests and problem reports.

Appendix A – Abbreviations and Acronyms

ADPE	Automated Data Processing Equipment
CCB	Configuration Control Board
CI	Configuration Items
CM	Configuration Management
COTS	Commercial Off-The-Shelf
CSOC	Consolidated Space Operations Contract
DDCS	Document and Data Control System
DR	Discrepancy Report
DSMC	Data Service Management Center
EC	Engineering Change
EES	Earth Exploration – Satellite
ESA	European Space Agency
FOTS	Fiber Optic Transmission System
GN	Ground Network
GSFC	Goddard Space Flight Center
GUI	Graphical User Interface
HDRC	High Data Rate Controller
HMD	Hardware Maintenance Department
ICD	Interface Control Document
IDD	Interface Definition Document
ISS	Inter-Satellite Service
ITU	International Telecommunications Union
KaSA1NB	Ka-Band Single Access-1 Narrowband
KaSA2NB	Ka-Band Single Access-2 Narrowband
KaSAR	Ka-Band Single Access Return
KaSAR1WB	Ka-Band Single Access Return-1 Wide-band
KaTP	Ka-Band Transition Product
LEO	Low Earth Orbit
LNA	Low Noise Amplifier
LO	Local Oscillator
LOP	Local Operating Procedures
MOC	Mission Operations Center

NASA	National Aeronautics and Space Administration
NASDA	National Space Development Agency of Japan
NCCDS	Network Control Center Data System
NISN	NASA Integrated Services Network
O&M	Operations and Maintenance
ORR	Operations Readiness Review
PIO	Project Integration Office
POC	Point Of Contact
PVM	Performance Verification Matrix
RF	Radio Frequency
RFA	Request For Actions
RMA	Reliability/Maintainability/Availability
SCA	System Configuration Audits
SCDS	Space Communications and Data Systems
SED	Systems Engineering Department
SGLT	Space-Ground Link Terminals
SHO	Scheduling Order
SMTF	Software Maintenance Test Facility
SN	Space Network
SNIP	Space Networks Interoperability Panel
SODA	Space Operations Directive Agreement
SRD	System Requirements Document
STDN	Spaceflight Tracking and Data Network
SWE	Software Engineering
TDRS	Tracking and Data Relay Satellite
TDRSS	Tracking and Data Relay Satellite System
TOCC	TDRSS Operations Control Center
TRR	Transition Readiness Review
TRT	Technical Review Team
WSC	White Sands Complex

Appendix B – PROJECT DELIVERABLES

Deliverables	Document Number	Responsible Organization	Delivery Date
Systems Engineering			
Project Commitment Document	N/A	NASA-GSFC	04-05-00
KaTP System Requirements Review	N/A	NASA-GSFC	07-27-00
System Requirements Document	450-SRD-KaTP	NASA-GSFC	03-02
KaTP System Design Review	N/A	WSC and WFF SED	12-19-00
KaTP Management Plan	453-PMP-KaTP	NASA-GSFC	09-01
KaTP High Data Rate Demonstration Plan	453-DP-KaTP	NASA-GSFC	10-01
KaTP SN Demonstration Test Procedures	450-SNTP-KaTP	NASA-GSFC and WSC	09-02
KaTP SN Demonstration Test Report	450-SNTR-KaTP	GSFC	01-03 (Planned)
KaTP Performance Verification Matrix	450-PVM-KaTP	NASA-GSFC	04-02
KaTP SN Upgrades Transition Plan	N/A	CSOC	09-02
Transition Readiness Review Report	N/A	WSC-SED	01-03 (Planned)
WSC KaTP Engineering Change Documentation	EC-8272	WSC-SED	09-12-01
Hardware Specifications			
225 MHz Downconverter and LOs	LO-Spec.2	WSC-CSOC	08-17-01
650 MHz KaTP Downconverter SOW and Technical Specification	DC_SOW_@	WSC-CSOC	02-20-01
650 MHz Equalizer	EQ Spec 2 WG	WSC-CSOC	09-06-01
IF Switch	IF SW RFP.1	WSC-CSOC	01-19-01
FOTS	FOTS RFP.1	WSC-CSOC	12-11-00

Appendix C – Points of Contact

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